CLAIMS

1. A generating device (5) suitable for the definition of races (20) of the worm (2) in a worm-gear reduction unit with circulation of bearing balls (1), comprising a main body shaped as an angular portion of the worm wheel (3) apt to mate with said worm (2) and having an extension equal to an angular pitch of the worm wheel (3) itself, onto which portion is added the envelope of the position of a ball inside the race (30) of the worm wheel (3), the centres of which ball define a reference cylindrical helix and wherein the radius of the ball is not necessarily identical to that of the ball (4) circulating in the reduction unit.

2. The generating device (5) according to claim 1, wherein the reference cylindrical helix has constant radius and is defined by equation:

$$\begin{cases} x_p = r_2^{rp} \cdot \sin(\gamma) \\ y_p = r_2^{rp} \cdot \cos(\gamma) - (r_2^{rp} - r_2^{vp}{}_{min}) \\ z_p = p_{el} \cdot \gamma \end{cases}$$

wherein the various symbols denote: γ the anomaly of the point going along the cylindrical helix in a transverse plane of the worm with respect to the median transverse plane of the worm wheel ; r_2^{rp} the curvature radius of the pitch line of the worm wheel in the median transverse plane of the worm; $r_2^{vp}{}_{min}$ the curvature radius of the pitch line of the worm in its median transverse plane; p_{el} the pitch of the helix.

3. A cutting tool-gear (7) apt to cut the races (20) of the worm (2) in a worm-gear reduction unit with circulation of bearing balls (1), comprising a gear - shaped main body and a plurality of cutting elements (I-VI) having a plane profile arranged peripherally to the main body and in planes orthogonal to the axis of the cylindrical helix locus of the centers of the balls the envelope of which defines the generating device (5) of claim 1 or 2.

4. The tool-gear (7) according to the preceding claim, wherein each of said cutting elements (I-VI) has a substantially circular cutting profile.

5. The tool-gear (7) according to claim 3 or 4, wherein the cutting elements (I-VI) are differently aligned along one or more threads.

6. A method for cutting worm and worm wheel in a worm-gear reduction unit with circulation of bearing balls (1), comprising the steps of:

(a) obtaining races (30) for the bearing balls (4) onto the worm wheel (3); and

(b) obtaining races (20) for the bearing balls (4) onto the worm (2),

wherein said step (b) provides the cutting of the races (20) according to a reference cutting profile substantially corresponding to the envelope of the subsequent positions assumed by the balls within the worm wheel races being formed.

7. The cutting method according to claim 6, wherein said step (b) provides that to the worm (2) and to a cutting generating profile (5) there be given, as cutting motions, the motions of the worm (2) and of the worm wheel (3) of the worm-gear reduction unit (1) being constructed, respectively, said cutting motions of the worm (2) and of the generating profile (5) being bound by the relation:

$$\varphi = \tau \cdot \theta \ ,$$

wherein τ denotes the transmission ratio desired for the worm-gear reduction unit (1), ϕ the rotation of the worm (2) and θ the rotation of the generating profile (5) in a transverse plane (YZ) of the worm wheel (3).

8. The method for cutting according to the preceding claim, wherein said step (b) is carried out by using a single cutting element in different machining passes.

9. The method for cutting according to the preceding claim, wherein said single cutting element has a substantially plane cutting profile.

10. The method for cutting according to claim 8, wherein said single cutting element has a cutting profile with a substantially circular, elliptical or ovoid shape.

11. The method for cutting according to claim 6, wherein said step (b) is carried out by using different cutting elements.

12. The method for cutting according to any one of the claims 6 to 11, wherein said step (b) is carried out in a single machining pass.

13. The method for cutting according to any one of the claims 6 to 12, wherein said step (b) is carried out by using one or more cutting elements and wherein said or each cutting element is constantly arranged, in its cutting motion, with an axis (A^t)

thereof incident to the longitudinal axis of the reference cylindrical helix.

14. The method for cutting according to any one of the claims 6 to 13, wherein said or each cutting element is rotated, during the cutting motion, about an axis thereof orthogonal to the cutting profile according to the relation:

$$\alpha = arc\tan\frac{r_1{}^{rp}{}_{\min}\cdot p^{v}{}_{ang}}{2\pi\cdot\left(r_2{}^{vp}{}_{\min}+r_1{}^{rp}{}_{\min}\cdot\left(1-\cos\theta\right)\right)},$$

wherein α denotes the helix angle and $p^{v}{}_{ang}$ the angular pitch of the worm (2).

15. The method for cutting according to any one of the claims 6 to 13, wherein said step (b) is carried out by a miller having a spherical head.

16. The method for cutting according to any one of the claims 6 to 15, wherein said step (b) is carried out in a single machining pass by a miller having an ellipsoid- or a revolution ovoid - shaped head.

17. The method for cutting according to any one of the claims 6 to 16, wherein said step (a) is carried out by giving to a cutting element an helical cutting motion for each race (30) of the worm wheel (3).

18. The method for cutting according to the preceding claim, wherein in said step (a) said cutting element is positioned with an inclination angle with respect to the axis of the worm wheel (3) equal to the angle of the helix described in said cutting motion.

19. The method for cutting according to any one of the claims 6 to 16, providing the use of a generating device (5) according to claim 1 or 2.

20. The method for cutting according to any one of the claims 6 to 16, providing the use of a tool-gear according to claim 3, 4 or 5.